

Final Report

Summary of Research

Period of Performance: 1/4/00 - 1/3/02

NASA-Dryden/GlennNAG4-202 (Project 53520)

***Integrating NASA Dryden Research Endeavors into the Teaching-Learning of Mathematics
in the K-12 Classroom via the WWW***

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Overview of Project

The primary goal of this project was to continue populating the currently existing web site developed in 1998 in conjunction with the NASA Dryden Flight Research Center and California Polytechnic State University, with more mathematics lesson plans and activities that K-12 teachers, students, home-schoolers, and parents could access. All of the activities, while demonstrating some mathematical topic, also showcase the research endeavors of the NASA Dryden Flight Research Center. The website is located at: <http://daniel.calpoly.edu/~dfrc/Robin>. The secondary goal of this project was to share the web-based activities with educators at various conferences and workshops.

To address the primary goal of this project, over the past year, several new activities were posted on the web site and some of the existing activities were enhanced to contain more video clips, photos, and materials for teachers. To address the project's secondary goal, the web-based activities were showcased at several conferences and workshops. Additionally, in order to measure and assess the outreach impact of the web site, a link to the web site *hitbox.com* was established in April 2001, which allowed for the collection of traffic statistics against the web site (such as the domains of visitors, the frequency of visitors to this web site, etc.).

Provided below is a description of some of the newly created activities posted on the web site during the project period of 2001-2002, followed by a description of the conferences and workshops at which some of the web-based activities were showcased. Next is a brief summary of the web site's traffic statistics demonstrating its worldwide educational impact, followed by a listing of some of the awards and accolades the web site has received.

Description of New Activities

- *Designing Your Own Spacecraft*

<http://daniel.calpoly.edu/~dfrc/Robin/Design-Plane/aircraft.html>

In this activity, students are given the opportunity to work cooperatively with their classmates in designing their own aircraft. The aircraft might be a passenger airliner, an attack aircraft, a cargo plane, a bomber, a test plane. Students will also be required to present their sketches (or 3-D models) to their classmates, describing and defending their choices for their aircraft and will provide a written description of their project. Serving as a backdrop to this activity are the variety of aircraft being tested at the NASA Dryden Flight Research Center including: attack aircraft, bombers, cargo planes, fighter aircraft, and other aircraft. In completing this activity, it is hoped that students' interest in what makes an aircraft fly will be sparked. This, in turn, might prompt students to begin considering a career in aerospace engineering or aviation.

- *Women in Space*

<http://daniel.calpoly.edu/~dfrc/Robin/Women-space/women.html>

In this activity, students will be given the opportunity to learn about the various contributions of women to the field of aerospace and aeronautics. Students will read the biographies of these women and then present their findings to the class in the form of a play or presentation. Serving as a backdrop to this activity is Marta Bohn Meyer, who currently serves as Director of Office of Safety and Mission Assurance at the NASA Dryden Flight Research Center and who was the first female crewmember assigned to the SR-71 aircraft. In completing this activity, it is hoped that more female students might consider a career in aerospace engineering or aviation.

- *Letters to the Man in the Moon*

<http://daniel.calpoly.edu/~dfrc/Robin/Plaque/plaque.html>

In this activity, students first learn about Neil Armstrong, the first human to step on the moon's surface, who was also a former X-15 pilot who flew many other research aircraft at the NASA Dryden Flight Research Center. Armstrong left a plaque on the moon in July, 1969, commemorating man's accomplishment. With this in mind, students are challenged to work collaboratively to develop their a moon plaque should they be chosen to fly to the moon. This activity gives students the opportunity to write, communicate mathematically with their classmates, and defend their reasoning, activities that are not encouraged often enough in many mathematics classrooms. Additionally, students can discuss the mathematics that it took to allow us to conquer space and land on the moon.

- *Helios: A Real-Life Application of Ratio*

<http://daniel.calpoly.edu/~dfrc/Robin/Helios/helios.html>

In this activity, students will explore the concept of ratio by first discussing the concept of "aspect ratio" of the Helios Prototype, a project based at the NASA Dryden Flight Research Center. This will give students a real-life example of when ratios are used outside of the mathematics classroom. Then, students will use this idea of aspect ratio to find real-life objects that are taller (or shorter) than them by a certain amount. Thus, students will gain practice with ratio and measurement as well.

- *The Mathematics and Science of Eating Healthy*

<http://daniel.calpoly.edu/~dfrc/Robin/Food/food-k4.html>

In this activity, students will use the Internet to obtain information about the United States Department of Agriculture's (USDA) recommendations for a balanced diet. Then, using this information, students engage in activities in which they plan, taste-test, and design menus for a shuttle mission. Throughout these activities, students will be working collaboratively, honing their measurement and computational skills, and learning of the connections between mathematics and science. Serving as the backdrop to this activity, are the Space Shuttles which land at Edwards Air Force Base, California, when the Kennedy Space Center is not available. The NASA Dryden Flight Research Center is based at Edwards.

- *Understanding Hurricanes and the ER-2*

<http://daniel.calpoly.edu/~dfrc/Robin/Hurricane/hurricane.html>

In this activity, students will gain an understanding of hurricanes; in particular, what they look like, how they are formed, how they are categorized, how they are named, and how they are tracked. Thus, the goal of this activity is for students to understand the science of hurricanes as well as the mathematics of hurricanes. Serving as the backdrop to this activity, students will learn about a particular NASA Dryden aircraft namely, the ER-2, which is used to collect data about hurricanes.

- *Desperately Seeking NASA Dryden and the Other NASA Centers*

<http://daniel.calpoly.edu/~dfrc/Robin/SeekFind/seekfind.html>

In this activity, students pick any topic (in this case, it is learning the names of all of the NASA Centers, including those other than the NASA Dryden Flight Research Center) and then, using their spatial and critical thinking skills, manually develop a seek-and-find puzzle to challenge their classmates. Students can then access an online seek-and-find puzzle to challenge themselves! In completing this activity, it is hoped that students will build and test their vocabulary in a fun and engaging fashion, and enhance their spatial and critical thinking skills.

Listed below are several activities designed by graduate students, enrolled at the University of Arizona, under the guidance of the principal investigator of this project. These activities are in the process of being posted.

- Using the Dryden Flight Research Center to Understand Fermi Problems
- The Relationship of Altitude vs. Pressure
- Traveling at Mach 7
- Understanding Torque In Motion
- Angles and Aircraft
- Finding Locations and Distances using Global Positioning System (GPS) Devices
- Helios: Graphing the Ascent and Descent and Fitting a Curve using the TI-82
- Communicating with Helios

Conference Presentations and Workshops

- *NASA Educational Workshop (NEW), July, 2001, NASA Dryden Flight Research Center*

In July, 2001, the NASA Dryden Flight Research Center's PACE Office hosted a workshop attended by twenty-five exemplary K-12 teachers from across the United States. One module offered at this week-long workshop was entitled, "Making the Learning of Mathematics More Meaningful and Fun." The goal of this three-hour module was to engage participants in a variety of hands-on, web-based, mathematics activities showcasing NASA Dryden's research endeavors. During this module participants also discussed the importance and implications of making the teaching and learning of mathematics more contextual and applications based.

- *NASA Ambassador's Workshop, September, 2001, NASA Dryden Flight Research Center*

In September, 2001 a module similar to the one offered at the aforementioned NASA Educational Workshop was to be offered; however, due to the tragedy at the World Trade Center, this module and workshop have been postponed.

- *SECME Summer Institute, July 2001, University of Arizona*

In July, 2001, SECME (Southeastern Consortium for Minorities in Engineering) hosted its Summer Institute at the University of Arizona. During this two-week long workshop, two four-hour modules entitled, "NASA Mathematics" were offered to participants who were exemplary K-12 teachers from across then United States. During these two modules, participants engaged in a variety of hands-on mathematics activities posted on the web site, <http://daniel.calpoly.edu/~dfrc/Robin>.

- The web site was to be explored at the National Council of Teachers of Mathematics (NCTM) Annual Conference in April 2001, Orlando, Florida and at the NCTM's regional conference in August, 2001, in Laramie, Wyoming. However, due to health problems, the principal investigator was unable to attend these conferences.

Prior to the close of the July 2001 NASA Dryden Educational Workshop and the July 2001 SECME Summer Institute, participants of these workshops/conferences were asked to complete a closed- and open-ended survey, developed to assess the effectiveness and usefulness of the mathematics activities posted on the web site. The results of the survey were then tabulated and recorded. In the open-ended portion of the survey, teachers were asked to list the strengths of the activity(s) they viewed on the web site as well as suggestions for improvement. The closed-ended portion of the survey contained the following three questions to which respondents answered using a five-item Likert scale ranging from "strongly disagree" to "strongly agree."

- This activity would be meaningful/motivating to students.
- The directions to implement this activity were easy to understand and follow.
- I would recommend this activity to other teachers.

The results of the survey indicated strongly that the teachers were very pleased with the quality and content of the activities posted on the web site.

Website Traffic Statistics

Since its first appearance in the summer of 1998, the website has enjoyed approximately 300,000 users. Approximately four to six emails are received monthly from users commenting on the web site's usefulness and creativity. In many of the emails, individuals or organizations have asked for permission to use our materials or have requested to link to our website.

In April 2001, a link to *hitbox.com* was established in order to collect traffic statistics against the web site. Since April 2001, the web site has enjoyed approximately 62,000 visitors from 97 different countries internationally. Additionally, a total of 36 unique K-12 domains have visited the web site and a total of 100 unique university/college/community college domains have visited the web site.

The most frequently visited pages are as follows:

- home page (28%)
- elementary grades (K-4) activities page (13%)
- middle grades (5-8) activities page (11%)
- algebra activities page (6%)
- high school level (9-12) activities page (6%)
- other 36% is distributed across different activities' pages.

Awards and Accolades

The website has received the following awards and accolades during the project period:

- Selected for addition to KinderStart.Com (www.KINDERSTART.COM), the web's largest indexed directory for parents and caregivers.
- Linked to IDEAS Portal Web Site (ideas.wisconsin.edu), an educational web site.
- Selected as a featured site in Lightspan's StudyWeb (www.studyweb.com), an educational web site.
- Contacted by the Instructional Technology Facilitator for Franklin County Schools in NC and asked for permission to maintain a link to our website from their resource page so that teachers and students could access our site.
- The Teacher Information Network (www.teacher.com) asked for permission to include the web site as one of their teacher resource links.
- Contacted by Clear Educational Solutions (www.clredusol.com/) and invited us to link to their site.